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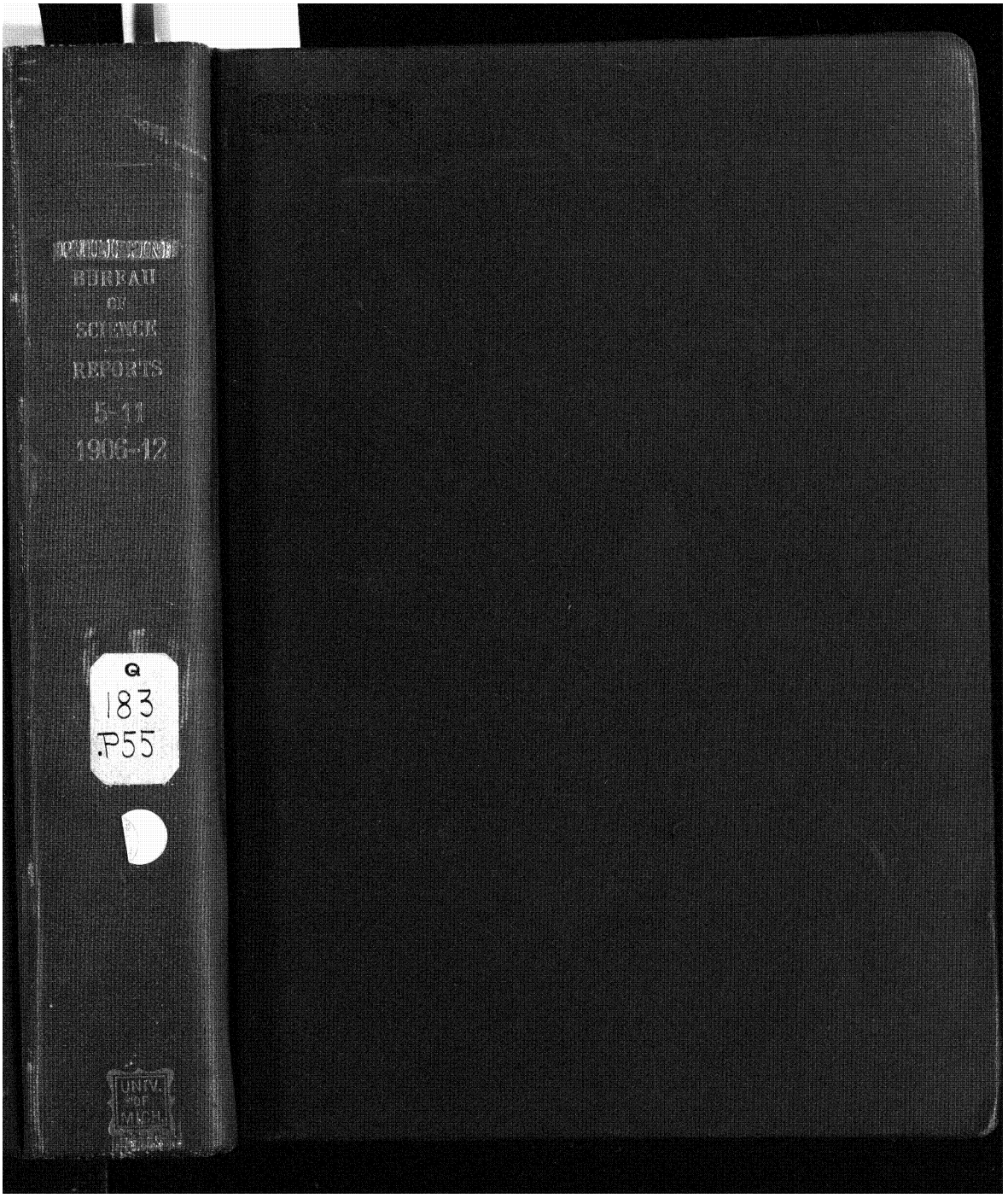

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SIXTH ANNUAL REPORT

OF THE DIRECTOR OF

THE BUREAU OF SCIENCE

TO THE HONORABLE

THE SECRETARY OF THE INTERIOR

BY

PAUL C. FREER

DIRECTOR OF THE BUREAU OF SCIENCE

FOR THE YEAR ENDING AUGUST 1, 1907

MANILA
BUREAU OF PRINTING
1908

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SIXTH ANNUAL REPORT OF THE DIRECTOR OF THE BUREAU OF SCIENCE.

DEPARTMENT OF THE INTERIOR,
BUREAU OF SCIENCE,
Manila, August 5, 1907.

SIR: The following report gives an account of the work performed in the Bureau of Science for the period from August 1, 1906, to August 1, 1907, together with such recommendations as to future improvements as seemed to me to be necessary.

THE ETHNOLOGICAL MUSEUM.

The Ethnological Survey, which was formerly a Bureau of the Government and which was transferred as a division to the Bureau of Education on November 1, 1905, was placed in charge of this Bureau one year thereafter. This division up to the present time has been confined to temporary and inadequate quarters; first in the district of Malate, subsequently in the General Government building on Plaza Binondo, afterwards in the Bureau of Education. It has never had a place for the proper care and display of its materials, and therefore deterioration, breakage, and loss was the inevitable result. During the present year, sufficient funds have been available in the appropriation for this Bureau to alter and repair the quarters formerly occupied by the Bureau of Architecture and to place them in a fit condition to receive the ethnological museum. The transfer of this building to this Bureau was brought about after considerable delay and the adjustment of the appropriation was also accomplished late in the fiscal year, so that we are only now in the position to begin to move the collection. Show cases in addition to those already on hand have been built, racks to hold weapons, shields, etc., placed on the walls, shelving put in to accommodate specimens, and the entire space renovated and put in condition for a public museum. It is proposed to have this museum open to the public during certain hours of the day, and it is hoped that the migrations of the division of ethnology are now at an end.

About one-fourth of the floor space available has not been utilized at present. It is obvious that room must be left for expansion of the ethnological museum and for other purposes. It is not deemed advisable to place the working collections of the Bureau of Science, such as the

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botanical herbarium, the ornithological, geological, and other collections in this building for many fundamental reasons. Some of these are: The distance from the central scientific bureau, which would operate especially to the detriment of both the botanical work and the investigations carried on in the Bureau of Science building which need the assistance of the botanists; the journey to and from the library is also one of the considerations and this is even a more serious matter. Much of the future work in botany will need laboratory facilities for the study of the histology of Philippine woods and of plant physiology and pathology, and none of the facilities for such investigations will be available in the new building. Therefore, it seems fundamentally necessary to provide room on Calle Herran for that class of work in the Bureau of Science which depends upon scientific collections.

THE NEED OF A COMMERCIAL MUSEUM.

In the past few years this Bureau has from time to time collected many specimens and prepared many products of commercial value in the development of the Islands; all of this material has been sent to various collections, exhibitions, and museums in the United States and none reserved here, so that the Islands are confronted with the fact that, whereas we are in every way endeavoring to enhance the availability and volume of our natural resources, we have nowhere in Manila a place where strangers visiting the Islands can go to view specimens of the natural products and to obtain the commercial information which is necessary for their intelligent understanding. Such a place should be in connection with the ethnological museum, which is already established. However, a commercial museum would be of little value were it not provided with a good division of information, a thoroughly competent man at its head and sufficient clerical assistance to collate and supply all details necessary to assist visitors in Manila. A classified and catalogued card system which would give all available information regarding the natural products, so collated that every detail available to the Government and to private persons would be collected in this central spot, would be of the greatest assistance in advancing the interests of the Islands. The subject of Philippine coals furnishes an example. There should be a place where a visitor could ascertain at once and with the greatest facility the result of all analyses which have been made on Philippine coals, the percentage of efficiency resulting from boiler tests, the location of the coal beds, the means of transportation to and from their location, the expenses of labor in the various districts, the wharfage facilities, and so forth. Again, if, for example, a stranger were interested in a product from some of the unexploited oil seeds or nuts found in the Islands, information as to the availability of these seeds, the opportunities for collecting, the percentage and the quality of the oil, and all other data regarding them should be available in such a division

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of the Government. The various grades of Manila hemp and the methods of reaching a classification should be on file, and in each instance museum specimens should accompany the records. The above are only a few examples which come to mind owing to past experience, and new questions are constantly arising.

The system to be inaugurated would need to be thoroughly organized with means of obtaining very accurate and complete information, otherwise the project should not be undertaken. One essential feature should be a complete collection of catalogues and price lists. The market values of all local and foreign commodities which may be a factor in the development of the Islands should be available, as under present conditions it is sometimes necessary for the visitor to call upon a number of Bureaus to gather his information section by section, with the possible necessity of making a long journey through the provinces in order to obtain even a preliminary view of the field.

Much information which could really be made available is not now collected for the reason that there is no uniform system, and each Bureau of the Government is simply obtaining such data as it deems necessary for its own work. Such offices as the Bureau of Education and the Constabulary could be utilized for systematically furnishing details from the provinces in regard to products, routes, or maps, and the mere fact that the attention of teachers and Constabulary officers is being called to the desirability of such facts and the existence of a central office for their proper handling will do much to stimulate activity in the line of gathering information.

AN ADDITION TO THE MAIN LABORATORY BUILDING.

In the past annual reports attention has been called to the overcrowded condition of the building of the Bureau of Science. The inauguration of the new Medical School, and the necessity not only of providing space in this building for the advanced work of the faculty but also of taking in a number of advanced students who need better facilities than can be afforded in the Medical School, renders the necessity for increased space in the building of the Bureau of Science more and more apparent. The botanical, pathological, mineralogical, geological, and ichthyological collections are growing rapidly and the space available each year becomes proportionately less. The subject was so strongly urged before the Commission that authority has finally been granted to have plans drawn for a wing approximately 110 feet long and 50 feet wide. This addition would provide for the herbarium, the work in entomology, the collection of natural-history specimens, the division of mines, and the new undertaking in the study of fish and fisheries. It is essential to the unity of the work and to the plan of a central scientific institution that the working collections, together with the staff connected with them, should not be separated from the main structure. The need of intimate intercommunication has

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developed more and more as the age of the Bureau increases and the vigorous carrying on of new work is only possible under the stimulus of proper surroundings. Future plans should also contemplate the union of the ethnological and commercial museums under the same roof as the working collections of the Bureau and connected with the present building.

THE NEW WORK IN FISH AND FISHERIES.

We have during the past year, in addition to the amalgamation of the Ethnological Survey with the Bureau of Science, added work in fish and fisheries. This has begun in a modest way by engaging the services of Mr. Alvin Seale, who has a large experience in the identification of tropical and especially Philippine fishes. Authority has also been obtained for a voyage of the United States Fish Commission vessel *Albatross* to the Islands, for the purpose of exploration and investigation, the Philippine Government furnishing the necessary coal during her stay in these waters. It is obvious that, while this Government will obtain many advantages from this exploratory expedition, full and permanent results will not be available until we make up our minds to continue the division of fisheries as a permanent institution with equipment and facilities of its own. It is very certain, owing to the fact that the Philippine Government will provide the coal for the *Albatross,* that it will be entitled to complete duplicate sets of the collections to be made and also to a prompt report on the best means to be taken to increase the commercial availability of the marine fauna, but this is not all. It should be in a position to secure advanced advice and results before the appearance of the probably extended discussion which will be printed in Washington. I hope that during the visit of this vessel to our waters, plans may be begun and funds become available for establishing the system of floating scows which I have advocated in the past. The division of fisheries is certainly of great importance when we consider the food value of the marine fauna to the people, and it should be continued with adequate facilities, aquaria, and personnel after the first exploratory work is over. One feature which I have dwelt on in the past, which I still consider to be not only advisable but almost necessary in this work, is the establishment of a public aquarium for the use of the people of the Islands.

THE PHILIPPINE MEDICAL SCHOOL.

The Director of the Bureau of Science was appointed dean of the school in December, 1906, and as so much of the work of the new institution is connected with that of the Bureau of Science, an account of the progress of the school is included in this report.

The Philippine Medical School was brought to a working basis during the past year and it opened its doors to pupils on June 10, 1907, the total number of admissions being fifty-four. The Commission appropriated

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sufficient funds to establish four years of the course at the present time, for although the board of control and the faculty decided that a five years' course was necessary in the Philippine Islands, it was obvious that no students would immediately be available for the fifth year. The object of the school is as rapidly as possible to train Filipinos as physicians, but with the conditions which confront us, it does not seem feasible to allow the students to graduate with less than a five years' course of study. However, it appeared necessary, in order to give an opportunity for many applicants who had not been trained in the Government schools, for the present to be somewhat lenient in the entrance examinations, the standard to be gradually raised as a larger number of the Philippine population becomes familiar with our methods of preliminary study and with the English language. It was also deemed essential to admit as advanced students a number of applicants who had previously studied medicine in other schools. While they have not the preliminary training which we will require of our own beginning classes, neverthless, by such admissions we will be giving an opportunity for many to take laboratory work and to become familiar with laboratory methods of instruction, who otherwise might not have been able to gain these advantages. The students in question will undoubtedly be more or less weak in the beginning work, but they nevertheless will be available for sanitary work in the Islands much sooner than if we were compelled to wait for the first freshman class to graduate. They have been admitted as special students and will only be considered candidates for a degree if after one year of study they prove themselves to be fit to continue the work.

As soon as the doors of the school were opened one great necessity at once became apparent, and that was the need of increased clinical facilities. The material at St. Paul's Hospital is practically all that is available. The Civil Hospital is a pay institution and at such a distance from the Medical School that the loss of time in journeying to and fro is prohibitive. This lack of clinical material emphasizes even more strongly the fact that the Philippine Islands need and must have a well-equipped general hospital, with a minimum of 350 beds for the first year. Indeed, for a city of the population of Manila, with its many near-by suburbs, an institution of 1,600 beds would ultimately not be unreasonable. The necessities of medical instruction will then inevitably lead to the conclusion that the faculty of the school must also comprise the staff of the hospital, and such being the case it would seem more advisable to have the hospital under the immediate direction of the board of control of the Medical School, rather than to place it under any one Bureau.

It seems evident, to judge from the results of the first year, that we must expect larger and larger entering classes as time goes on, and the temporary quarters of the school will soon be inadequate. An appropriation of ₱250,000 has been made for the construction of a new

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building which is to be in close proximity to the present laboratories of the Bureau of Science.

The advantages of the Medical School will be felt not only in the training of pupils and in the general intellectual advance of the people, but also in the fact that its establishment will be another step toward making Manila the medical center of the Orient. Already we have called to the school an anatomist and a pathologist who are thoroughly trained in their respective lines, and we hope within the next year to be able to call to the faculty a physiologist and a pharmacologist.

The gradual rounding off of the Medical School is therefore begun and no one who realizes the reputation which in the past the Philippines enjoyed from a sanitary standpoint, and who compares this reputation with the real facts as they exist to-day, will hesitate to say that the future advance in medical education, with the forming of a thoroughly competent medical faculty and hospital staff, will be one of the greatest factors in promoting the interests of the Islands.

The Bureau of Science has been especially affected by the opening of the Medical School, because six of its members are more or less actively engaged in teaching. The pressure on this Bureau in this respect has been far greater than that on any other; in fact up to the present time no other Bureau has been in a position to give any great amount of assistance. This condition of affairs is obviously one which necessitates extra work and which also makes it necessary to keep the biological staff of the Bureau at a maximum at all times.

A GRADED SALARY LIST IN THE BUREAU OF SCIENCE.

The appropriation for the present year will enable the Bureau gradually to introduce a graded salary list in all divisions and so it will be able to offer greater inducements for men to come to the Islands to take up scientific work and to remain in the service. While it is true that no changes have been made in the lower salaried positions, nevertheless the plan of grades will be such that members of the scientific staff will have a steady opportunity for promotion as resignations occur in the places above them, until they reach the highest positions. The intervals between the salaries have been so adjusted as to apply equally to all divisions of the scientific work and in the future it will be the fixed policy of the institution to allow no changes in salary for the benefit of the individual, but to improve the condition of the members of the staff by regular, graded promotions. Such opportunities should form a great inducements for prospective candidates to enter the service of this Bureau, as before they are admitted they will have before them a clear and permanent schedule of the places above them, and a definite knowledge of what they may expect.

However, advancement to the upper positions will only be possible to those in the lower ones who have shown themselves capable of in-

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dependent endeavor and investigation. If such promotions were to be made simply because of length of service, the ultimate condition of the laboratory would be to have all of the higher positions filled by persons incapable of advancing the work of their respective divisions and not fitted to direct the research or the scientific work of those below them. Such a condition would involve the stagnation and ultimate dissolution of the laboratories.

The keeping in a subordinate position of a man who has not shown himself capable of advancing his work to the higher plane of investigation and direction will of course be a situation which will bring its difficulties upon the Director, as ultimately he alone will have to give the decision and run counter to the hopes of a number of employees who may be doing faithful and conscientious work, but a rigid application of the policy of reserving the higher places only for those who are capable of following advanced and independent research is so obvious that the situation will have to be faced in each individual instance and action taken accordingly. Such a condition must confront everyone who has charge of an institution in which a large part of the work is that of scientific investigation, and no mechanical method of promotion can be devised which will give the efficiency necessary for the maintenance of this Bureau on the high plane which it has assumed in the past. This condition must be thoroughly understood by prospective candidates before they enter the service, so that if they are not capable of the work of the investigator they need not unduly expect promotion to the upper grades. It may follow from this that in the future it will not infrequently happen that calls to the Bureau will be made directly to the higher salaried positions.

In the plan of the appropriation it was taken into account that the adjustment of salaries and promotions in the scientific force would not, excepting in special instances, be made sooner than one year after the previous promotion had taken place, and if this policy is carried out the Bureau can meet its salary obligations on the new basis. It will be true that the next following year, if it should chance that all places available on this basis would be filled, the present appropriation would be insufficient. This must be taken into account before the end of the present fiscal year. However, it has invariably been true in this Bureau, as in others, that all positions are not occupied at one time, and it is also true that toward the end of a given fiscal year a number of employees usually take their vacation and have their leaves commuted. Such commutation obviously relieves the next fiscal year. The exact sum necessary to meet all of the salaries as they have been authorized can therefore not definitely be stated at present. A very few future alterations in the salary list can advantageously be carried out when the time comes, by the consolidation of two or more lower paid positions into one higher one. Under these conditions we may look forward to

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a gradually increased usefulness in furthering the interests of the Islands.

The attention of the Bureau in the past few months and probably for a few months to come, has necessarily been distracted by the beginning of the new Medical School and by the plans for organization and buildings, both old and new, which it has been necessary to consider. It is probably a conservative estimate that the results of the present plan of organization will not begin to be felt until six months have elapsed, when it is hoped that all changes will have been made and the institutions with which we are connected will be on a permanent working basis.

ROUTINE WORK.

Routine analyses and examinations of the kind we have been accustomed to in the past have recently diminished. This diminution is owing to the fact that the Bureau of Customs has gradually had many of the questions adjusted which needed laboratory advice, that the Bureau of Agriculture has not continued its policy of extensive soil analyses, that the Bureau of Health and other Bureaus have also in the past few years of experience gradually advanced themselves to a condition where fewer analyses are necessary. In the Biological Laboratory, we shall as a result have an increased opportunity for the careful study of tropical diseases, where in the past much time has been taken by the wholesale routine examinations which could not thoroughly be considered and digested, an example of such wholesale routine examinations being the examination of rats for plague. It is therefore hoped that the next years will bring more permanent results in the understanding of our hygienic conditions. An advance is already being made in the study of animal parasites which affect a large number of prisoners at Bilibid and which are believed to be a serious factor in the present mortality among the people of the Islands. While such parasites may not be the immediate cause of death, nevertheless, in weakening the condition of the populace they do give opportunity for the more ready attack of the people by other serious diseases. A further discussion of these questions will be made under the heading of the Biological Laboratory.

The decrease in the custom-house and other routine analyses in the chemical laboratory has been more than offset by the work of standardizing weights and measures, which at times has been very heavy and exacting, and by the greater number of determinations we have made for private persons and firms, and as soon as we are able to make feasible the operation of Act No. 1655, which has as a short title "The Pure Food and Drugs Act," we shall within the next few months have coming to the laboratory daily a large number of analyses, so that the routine work for the next year in this branch of the service will presumably show a very large increase.

One matter which should be brought to the attention of the various

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Bureaus is that the chemical laboratory is in a position to examine and test materials purchased in large lots. It has always been a matter of surprise to me that organizations such as the Bureaus of Supply, of Public Works, and others, which deal in contracts for paints, oils, varnishes, alcohol, steel, and iron, have not systematically subjected their contractors to rigid laboratory examinations as to the quality of their goods. Samples of all articles of the above and other classes which are purchased for the Government unquestionably should be submitted to the laboratory as a regular routine performance. The results would save the Government loss in the purchase of inferior articles and would assist in every way in the saving of money. The laboratories have been organized with this as one of the ends in view, and advantage has not been taken of the chemical laboratory for the examination of materials to as great an extent as should be the case. It is also suggested that many instances might arise where officials of the Government other than those connected with Bureaus could very well refer matters of scientific importance to the laboratories as a preliminary to further consideration.

A CEMENT-TESTING LABORATORY.

The testing of cement is at present undertaken in several divisions of the Government and probably, as a cement-testing apparatus is not very expensive and the whole time of one man in each division is not necessary, the separation of this class of laboratory work in several parts of the Government is not a detriment as regards expense. Nevertheless, attention should be called to the fact that if all of this work were to be carried on in the central laboratory, it would be of so great a volume as practically to occupy the time of one man with one or two assistants, and consequently a probable reduction of cost would be apparent. A greater additional advantage is found in the fact that the person making the tests would be a man thoroughly trained for this purpose, who would ultimately have a very extended experience with all of the classes of cement imported into the Islands, and so a central place would exist where all knowledge as to the standard and quality of these materials would be concentrated. Such a procedure would also assist the laboratories in working out the problem of the development of the native cement industry. Therefore, for many reasons it would seem advisable to have all work on cement testing done in one institution.

MAP WORK IN THE ISLANDS.

The Bureau of Science, as has been the case with other Bureaus and divisions of the Government, has been much hampered by the confusion and contradictions which are found in the existing maps of the Islands. Good maps are very useful for our collectors, and topographical maps are necessary for the division of mines. It is to be hoped that during the present year some steps may be taken toward uniting the results of

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all map work being carried on under the Government and thus establish a progress map of the Islands. A beginning in this direction is already planned. A complete topographic map of the Islands, even with large contours, would be very expensive and the cost could scarcely be met by this Government, but it is perhaps possible that these surveys which are so fundamental to work in the Islands may at some time be undertaken from funds appropriated by the Congress of the United States, and by officials of the Geological Survey. If money were ever to be appropriated for this purpose it is certain that we in the Philippines who are interested in the matter would give all the assistance in our power.

STOCKS HELD BY THE PURCHASING AGENT.

One change which threatens seriously to hamper our work is the reduction in stocks held by the Purchasing Agent. We have been accustomed to hold in reserve many chemicals and pieces of apparatus for which the Bureau has not sufficient storage room. Some of these materials may not be needed for two or three years, but no one can predict just what work we will be called to do during any given year. To purchase materials from abroad takes from six to nine months, and in the case of the common acids, supplies accurately calculated to last one year may be thrown overboard in transit, as has frequently happened. When a laboratory needs a certain thing it needs it badly, and the work must be suspended until it arrives. For these reasons, in the case of the Bureau of Science at least, it would be advisable to allow the Purchasing Agent to carry more than one year's supply.

THE LIBRARY.

The past year as a whole has been one of the most satisfactory in the history of the limrary. More has been accomplished than in any preceding one, although the work of systematic organization has only been begun. Nevertheless, many details which referred to old bills and vouchers have been settled after numerous discouragements and they will not again delay the work. The accessioning of the large number of volumes which came into the library in the early history of the Bureau, at a time when vouchers were not so clearly prepared and when large masses of books were brought in at a time, has been completed.

RENEWAL OF OLD ORDERS.

The old orders for books, which were outstanding and which had not been filled and which apparently were not being filled by the book dealers with whom they were placed, were canceled and replaced in the fiscal year 1907 by new orders for 458 titles. The result has been most satisfactory so that, with the exception of requisitions for books sent during the year 1907, there now remain only 56 of the above titles any part of which still are undelivered, and a number of partial deliveries of these

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have been made. The undelivered portions consist of books out of print and of parts of sets of periodicals and also of the publications of learned societies which are difficult to obtain in the book trade and which can only be secured as libraries and collections of books are offered for sale from time to time. Among the sets completed during the year the following may be mentioned: American Journal of Science (Silliman), Arbeiten des pharmakologischen Institutes zu Dorpat, Archiv der Pharmazie, Archiv für Dermatologie und Syphilis, Archiv für experimentelle Pathologie und Pharmakologie, Archiv für Schiffs- und Tropen-Hygiene, Archiv für Hygiene, Archives de Biologie, Archives des Sciences Biologiques, St. Petersburg, Beiträge zur chemischen Physiologie und Pathologie, Botanische Mitteilungen aus den Tropen, Centralblatt für Agriculturchemie, Centralblatt für die Grenzgebiete der Medizin und Chirurgie, Centralblatt für Gynäkologie, Chemische Industrie, Comptes rendus de la Société de Biologie, Deutsche medicinische Wochenschrift, Historische Studien aus dem pharmakologischen Institute zu Dorpat, Jahresbericht der Pharmacie, Jahresbericht der chemische Technologie, Journal de Médecine Vétérinaire, Journal of the Anthropological Society of Bombay, Journal of Botany, British and Foreign, Journal of the Straits Branch of the Royal Asiatic Society, Langenbeck's Archiv für klinische Chirurgie, Mittheilungen aus der Grenzgebiete der Medizin und Chirurgie, Monatshefte für praktische Dermatologie, Münchener medicinische Wochenschrift, Oesterreichische Chemiker-Zeitung, Oesterreichische Monatsschrift für Thierheilkunde, Paleontographica, Philosophical Magazine, Physikalische Zeitschrift, Prager medicinische Wochenschrift, Societas Entomologica, Stettiner entomologische Zeitung, Transactions of the Congress of American Physicians and Surgeons, Vierteljahresschrift auf dem Gebiete der Nahrungs- und Genussmittel, Wiener medicinische Wochenschrift, Zeitschrift für angewandte Chemie, Zeitschrift für Elektrochemie, Zeitschrift für Öffentliche Chemie, Zeitschrift für Pflanzenkrankheiten.

In addition to the above regular periodicals, the following important extensive works have been secured: Challenger Expedition Reports, 50 volumes; Wilkes Exploring Expedition, Mammalogy and Ornithology, 1 volume, with atlas; Herpetology, 1 volume, with atlas; Manual of Conchology, Philadelphia Academy of Science, Marine Univalves, 17 volumes; Catalogue of the Collection of Birds' Eggs in the British Museum, 4 volumes; Hand-List of the Genera and Species of Birds, British Museum, 4 volumes; Deutsche Klinik, etc.

NUMBER OF VOLUMES AND USE OF THE LIBRARY.

We are not yet in a position to give the exact number of volumes in the library, as the accession books have not yet been completed owing to the lack of clerical assistance, but it is probably a conservative estimate to place it at 25,000 volumes, exclusive of about 600 maps and of trade

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catalogues, which alone amount to more than 2,000. When the accession records are completed to June 1, 1906, and an inventory made from that date, we shall be able to give an exact statement of any losses which may have occurred, but only two books and six pamphlets have been reported as missing in the work up to June 30, 1904, and there is still a possibility that one or two of these may be found.

All of the titles which have been accessioned, including the pamphlets to June 30, 1904, have had book numbers assigned to them and shelf-list and main author cards made, but in about 10 per cent of the titles the class number has not yet been determined, consequently the cards are not yet ready for filing and use. No subject or title cards have been made for the entire series, but the work has been well begun.

The necessity of an assistant librarian has become so apparent since we have seriously pushed the work of accessioning and cataloguing, that the Commission authorized the position in the present appropriation bill and steps will be taken to obtain this employee at as early a date as possible.

Although this library is intended primarily for reference, the record of borrowers' cards for the year since the last annual report shows 3,848 titles taken out by 147 persons, this being in addition to the books taken by various Bureaus upon memorandum receipt, and reports from the latter also show a considerable circulation. It is certain that with the establishment of the Medical School the circulation of the library will gradually increase during the present year; it is already true that a number of the students are in the reading room daily working at the literature of the subjects with which they are occupied.

Fifteen hundred volumes have been forwarded to the printer for binding during the past year. We have also received the initial shipment of the printed cards of the Library of Congress, a partial set of which, including all scientific titles, was sent to this library without expense, the only requirement being that the cards should be filed and available for consultation. The proof sheets of all the cards printed by the Library of Congress are received regularly, and all cards desired are checked and ordered by serial numbers. This list should be of great assistance in bibliographical work.

It is certain that better service can be given at the loan desk with more assistance. The increasing use of publications taken outside of the building makes it important that this work should be attended to carefully and systematically. This is especially true because the library is so situated that it can not be locked, so that all possible protection must be given to guard against the loss of books. It would seem unfortunate to place doors and locks on the library, as it is so frequently used by responsible persons outside of the hours kept by the Bureau, but if our accessioning should at any time reveal any considerable losses, we shall probably have to install iron gates.

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MISSING NUMBERS OF PUBLICATIONS.

The greatest single piece of work undertaken during the year has been an effort to fill in the missing numbers of publications wherever it is necessary to complete volumes which need to be bound. This involves not only completing sets from the date of their publication but also the purchase of individual numbers. Many titles have been transferred to this library from time to time which contain incomplete volumes. Missing numbers were ordered for such volumes of these as the Bureau making the transfer desired to have completed and bound. A very serious question in the Philippines is the number of losses in the mails affecting our regular receipts both of subscriptions and exchanges. In some instances where journals have not come in the mail, we have waited for from one to three years to secure the missing parts from the publishers, or through exchanges, but without success. Eventually we have been compelled to order several thousand single numbers to fill the various needs, requisitions for 123 titles including from 1 to 135 numbers each being placed at one time. The making up of these orders requires careful and painstaking work to avoid duplicating numbers on hand, or obtaining something not wanted by the scientific workers, or reordering before there has been time to hear from the latest previous request, or failing to specify indexes and title pages where needed, and so forth. Probably not more than 25 per cent of these orders have been filled up to the present time, and it is more than likely that we shall need to do much more work and in some instances wait for years before these volumes are all completed.

During the present year we have done much to add to our stock of United States Government publications. We have received several hundred missing numbers from the Departments of Agriculture and of Commerce and Labor, the Geological Survey, and the various divisions of the Smithsonian Institution, and in one or two cases our sets have been completed with the exception of a very few numbers. A member of the staff is now on leave in the United States and he will make a personal effort to secure more of the missing numbers while he is in Washington. A list has also been submitted to the document division of the Executive Bureau, Manila, and it is hoped that some numbers may be secured from this source.

EXCHANGES AND THE JOURNAL OF SCIENCE.

A large number of the publications of foreign governments have been received during the year, and among these the reports on fish and fisheries are of especial importance. Exchange relations have been extended in many cases to include old numbers as well as current issues and much of value has been added to the library in this way.

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Actual exchanges for the issues of the Philippine Journal of Science now number 315 and many of the publishers have either sent or expressed their willingness to forward to us their earlier volumes in return for the previous publications of the various divisions of the Bureau of Science.

The Library of Congress also sends regular issues of "want" and "offer" lists to us, which we have already taken advantage of. It no doubt will often be possible in this way to secure missing numbers not available elsewhere. We are making up a complete list of our duplicates and wants, and in time hope to enter into exchange relations with many libraries and institutions.

The library, in addition to regulating the exchanges for the Philippine Journal of Science, has maintained general supervision over the mailing of all copies of the Journal not forwarded from the Bureau of Printing. This includes copies sent to the various other publications for review, samples for advertising purposes, numbers furnished to subscribers through our various agencies until the money is received by the Bureau of Printing, and the forwarding and keeping the records of advertising matter concerning the Journal. A record of the disposal of all previous publications from all divisions of the Bureau of Science has also been kept. We have been able to reduce the detailed work on the Journal during the past three months by completing a printed mailing list, so that now the business office takes care of the supervision of the mailing of the Journal of Science.

THE DIVISION OF BIOLOGY.

Only a few changes in the personnel of the Biological Laboratory took place during the past year. Dr. Philip H. Garrison, detailed from the Navy, reached here on January 10 to take the position of medical zoölogist of the Bureau of Science, and since that time his work has advanced rapidly in the study of parasitic diseases infecting the prisoners in Bilibid. A statistical paper on uncinariasis and the proportion of prisoners affected will appear in the near future. Other work, including the investigation of the life history of parasites and the identifications of new species is necessary and will take some time, but certainly good results may be expected. Dr. Garrison has also begun a helminthological collection in the pathological museum so that in the future we may have a complete record of all the parasites we have encountered as well as material for exchange with other museums. Eventually, this procedure will enable us accurately to identify many of the parasites of the Philippines and of other countries.

The position of clinical laboratory assistant so long vacant was finally filled by the arrival of Dr. Bowman.

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PLAGUE VACCINATION.

The chief of the Biological Laboratory, Dr. Strong, on July 2 left on vacation for Europe and the United States. Before going, he completed a long and painstaking work on the plague organism and the most advisable method of inoculation against plague. The extensive results, which involved experimentation with many small animals, appeared in the third number of the medical section, Section B, of the Philippine Journal of Science of this year. The work will certainly be authoritative on the subject of plague inoculation, and it is hoped that the method based upon the use of attenuated organisms will be given a rigid and extensive trial in countries where plague is unusually prevalent, and if such trial is given, the laboratory has every confidence in the results. Dr. Strong will work in various foreign laboratories during his leave and therefore will be partly carrying out the policy which has been the ideal one for the Bureau since its inauguration, namely, to have every scientific worker given an opportunity to visit the laboratories of other countries once in a certain period of years. In the instance of Dr. Strong this has been done by not utilizing his leave for the past four years, but it would seem desirable, in an institution of this kind, to have an arrangement by which each employee who would need the benefit of foreign study would have one year in five on full salary for this purpose.

PUBLICATIONS AND INVESTIGATIONS OF THE BIOLOGICAL LABORATORY.

The work of the Biological Laboratory has appeared in eight papers during the year, all of which have been issued in the Philippine Journal of Science. The titles are as follows: Studies in Beriberi, by Maximilian Herzog; The Cultivation and Pathogenesis of Amœbæ, by W. E. Musgrave and Moses T. Clegg; The Types of Bacilli of the Dysentery Group, by Y. K. Ohno; The Toxic Action of Saponin, by Harry T. Marshall; Agenesis of the Vermiform Appendix, by Harry T. Marshall and Ralph T. Edwards; Paragonimiasis in the Philippine Islands, by W. E. Musgrave; A Consideration of Some of the Modern Theories in Relation to Immunity, by Paul C. Freer; and Studies in Plague Immunity, by Richard P. Strong. A number of papers which represent last year's work are still in press. Among these are articles by Drs. Musgrave and Marshall on "Gangosa in the Philippine Islands," and a paper on "Infant Feeding," by Dr. Musgrave. The following investigations are under way but not yet completed: Dr. Musgrave and Mr. Clegg are occupied in a study of parasitic appendicitis, for which material is on hand, and a consideration of the treatment of malaria, with statistical studies of the cases in St. Paul's Hospital. Abundant material for this work is also available. Clinical observations on beriberi are partially advanced, but much more needs to be done. The same is true in the work

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on the subject of the use of the Roentgen rays in the treatment of this disease. Dr. Musgrave has also continued some of his previous work on amœbiasis, reports on ten cases of amœbic cystitis, two of amœbiæmia, and fifty of amœbiasis without diarrhœa being practically ready. The investigation on the symbiosis of amœbæ and its influence on the pathogenesis of the organism, the influences governing its virulence and observations on the biologic history of amœbæ are being continued. Dr. Musgrave has also just undertaken a series of studies on the biology and the cultivation of the *Bacillus leprœ* and on the transmission of leprosy to lower animals.

Drs. Musgrave and Bowman have begun a study of endemic parotitis. Dr. Marshall has studied and completed a work on a nodular form of amœbic dysentery and has finished a paper on gangosa in the Philippine Islands in conjuction with Dr. Musgrave. He has ready for publication a discussion of the histology of yaws and has undertaken the study of the toxins of the dysentery bacillus and of the cholera spirillum. He also proposes to begin work on the etiology and serum treatment of beriberi.

Dr. Edwards is engaged on the subject of conjunctivitis of the Tropics, and the study of certain fluke infections.

Dr. Ohno has been at work on the various types of dysentery bacillus; in addition he has endeavored to begin the preparation of rabies virus from material found in Manila and has carried the work along to a point where success seems reasonably certain. He has also undertaken the isolation and preparation of nitrogen-absorbing bacilli, so that in the future a supply may be available for agricultural work. The manufacture of mallein in the Bureau of Science has also been in the hands of Dr. Ohno.

The work of Dr. Garrison has already been mentioned in brief. He is engaged in a study of the life cycle of the trematodes and it is hoped that this obscure question may be cleared up in this laboratory.

The routine work of the Biological Laboratory has been lessened during the past year because of the absence of epidemic diseases so that it has been easy to keep it on a proper plane. However, a force must always be in readiness properly to handle any emergencies which may be brought about by epidemics.

The investigations which have been begun and outlines of which have been given above may seem too ambitious for the force we have and unquestionably some of the topics will not lead to far-reaching results, but out of the entire number some researches should result. The Biological Laboratory can only accomplish good results by a continuous and earnest attention to laboratory and, if possible, clinical investigation, by an effort at all times to secure material, even at personal sacrifice of time and inclination, and by a continued policy of actively and energetically pushing forward in its own field. It is not to be presumed that a man can always have at hand an absorbing and important topic. Research work in medicine must go with the materials available, but it

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is certain that any member of the Biological Laboratory who hopes to continue his connection with the Bureau must continually be prepared to make the most of his opportunities and to spend his time when not engaged in routine work, in investigations which he makes an effort to find, and not simply in waiting for what may come to his hands.

THE PATHOLOGICAL MUSEUM.

Mr. Willyoung in the last few weeks has undertaken the preparation of a card catalogue of the pathological museum and the relabeling with printed labels of all of the exhibits. This step has become necessary owing to the growth of the collection and it must be pushed rapidly to completion if we wish ultimately to avoid some loss. In addition to his work in sectioning and the preparation and care of specimens for the pathological museum, Mr. Willyoung was sent twice on trips through the Islands to assist the Bureau of Health in the positive diagnosis of leprosy in the cases of individuals to be transferred to the leper colony.

THE SERUM SECTION OF THE BIOLOGICAL LABORATORY.

The serum section of the Biological Laboratory on January 1, 1907, gave up the care and immunization of cattle used in preparing rinderpest serum, this work being transferred to the Bureau of Agriculture. Up to that date the preparation of anti-rinderpest serum was in immediate charge of Mr. Albert M. Newby. The Bureau, in the first days of the fiscal year, had its cold storage stocked with about 1,200 bottles of anti-rinderpest serum and as no epidemics of rinderpest of a serious nature were reported, it was decided gradually to eliminate from the herd a number of animals which were not desirable and to keep it at a minimum in the belief that the reserve serum would be sufficient to last the Bureau through the interval of time necessary to bring new animals to a point where serum could be taken. However, early in the year the call for serum from the Bureau of Agriculture became very serious and the reserve was rapidly exhausted, so that this Bureau was once more compelled to purchase a large number of animals and increase its herd. Seventy-two serum animals were transferred to the Bureau of Agriculture on the 1st day of January and since that time the latter Bureau has also been making extensive purchases. The system adopted is as follows: The Bureau of Agriculture sends to the Bureau of Science all serum after it is separated from the clots, the shipments being in 5-liter, sterile bottles. This serum is then centrifugated, filtered, tested for sterility, and bottled in the serum laboratory of the Bureau of Science.

One difficulty in the past and a cause of grave loss of serum has been its contamination by organisms. In the Philippine Islands, during the dry season when dust from the streets pervades everything, it is almost impossible to carry on an operation such as the taking of serum from rinderpest animals, where large quantities are required, in an absolutely sterile manner. Filtering the serum does not seem to be

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feasible as it soon clogs the filter, but in the latter part of 1906 it was ascertained that centrifugating the serum, and subsequently filtering it, rendered the latter operation easy, and beginning with that time all rinderpest serum has been centrifugated and filtered, so that losses from contamination are now avoided. As our present centrifuge is a small one and entirely inadequate to do the work, it was decided to purchase a large machine capable of holding 10 liters at one time and also to order a second serum-filtering apparatus, a duplicate of the present one, so that when necessary we could handle large quantities at a time. The apparatus has been ordered and it presumably will reach here before the end of the present year. It has a capacity of 10 liters and will require about 12 horsepower. When this new machine is in place it is hoped that we will be able directly to centrifugate the blood of the animals and not be under the necessity of allowing it to stand for the formation of the clot. The process of centrifugating blood should increase the yield of the serum very materially, and in that way cut down the expense of operation so that the centrifuge will pay for itself in a little over a year.

The preparation of vaccine virus has continued steadily throughout the year and no difficulty has been encountered in keeping on hand a sufficient supply of active virus to meet the demands.

We have had some trouble with our serum horses during the past year, especially with the ones we were immunizing with the living, virulent cultures of the pest bacillus. It has been found impracticable to employ old or condemned horses, as a number of this class developed severe arthritis in the legs, from which they could not recover. It appears that if living, virulent cultures of the *Bacillus pestis* are injected intravenously into a horse not perfectly sound, serious inflammation results. We have therefore been compelled to change to the use of perfectly sound horses and with these we have as yet had no difficulty.

Anti-diphtheritic and anti-tetanic serum has been supplied by the laboratory for some time and no change has been made in the methods of preparation. An increased demand for anti-tetanic serum has been evident during the year.

We are now immunizing horses against cholera, and hope, if we should have the misfortune to have a more or less severe outbreak of that disease, to have an opportunity of testing the curative value of the serum at the contagious-disease hospital of the Bureau of Health.

The serum for bacillary dysentery and for typhoid will soon be ready for distribution. The demand for cholera prophylactic and plague prophylactic has been practically nothing during the year, as no epidemics or even cases of the diseases in question have occurred. The demand for mallein has also been limited as glanders has become less frequent, but we have kept on hand a sufficient quantity of this product to meet the demand.

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INVESTIGATIONS OF THE SERUM SECTION.

A study of the etiology of rinderpest has been continued as vigorously as opportunity would permit, but no very positive results have been reached. We have not been able to cultivate the organism, and we have only been in a position absolutely to prove that the infectious material will not pass through the Berkefeld filter. Work in rinderpest will be continued and although the subject is one which has engaged the attention of the most prominent investigators in the field of bacteriology, it is nevertheless hoped that by continuous application and with proper methods we may be able to make a decided advance in this line. It would be a matter of fundamental importance if, by cultivating the bacillus, if such it be, we could eventually be able to support the virulent organism *in vitro*. The subject is certainly of sufficient importance to warrant an outlay of time and money, although it is possible that no fundamental results will be obtained. The fact that the organism does not pass the Berkefeld filter would seem to indicate that it should be visible under the microscope. An ultramicroscope reached this Bureau some four or five months ago, and it was hoped that with this instrument further advance could be made in the study of rinderpest. However, up to the present time we have had no opportunity to use the apparatus in any of our work.

THE BOTANICAL SECTION OF THE BIOLOGICAL LABORATORY.

The botanical section of the Biological Laboratory, as in the past, has been mainly engaged in pushing the herbarium and systematic botany. It has continued its good relations with the botanical workers abroad and its policy to obtain a return for the materials sent out. The identifications by the foreign investigators of Philippine materials have all been sent to the Philippine Journal of Science. Mr. Merrill went on a long leave toward the end of the year, after completing one of the most important expeditions, from a botanical standpoint, that has been undertaken in the Islands, namely, the ascent of Mount Halcon, in conjunction with Major Edgar A. Mearns of the Army; Mr. Merrill having the privilege of accompanying the expedition organized by Major-General Leonard Wood.

The herbarium at present contains somewhat more than 46,400 mounted sheets, well arranged in herbarium cases, but as has been mentioned in the past reports, it is located in extremely cramped quarters. The additions received during the year were 7,226 foreign and 8,749 sheets of local material. This is a larger amount, of both local and foreign material, than has been acquired during any previous year.

During the past year we have been engaged in a systematic collection of wood samples, properly identified and labeled, with herbarium specimens to accompany them. With the aid of the Forestry Bureau this

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collection has been rapidly augmented so that at the present time it contains representatives of a majority of the commoner commercial woods of the Islands. Of course, there is need of a large amount of collecting work before this series can be considered as approaching completion, but even now it is crowded for space, as is the case with the herbarium.

Early in the past year we built a bamboo structure for orchids at the rear of the main building and a large number of these plants have been brought in for study. Many of these orchids have been sent to America to Mr. Oakes Ames, of the Ames Botanical Laboratory, North Easton, Massachusetts, for identification, and a paper on this material was published in the botanical section of the Philippine Journal of Science.

Many determinations of botanical material sent in by the Bureau of Forestry and by private persons have been made during the past year, and several thousand determinations of wood specimens have also been undertaken for the Bureau of Forestry. Throughout, there has been the heartiest coöperation between this Bureau, the Bureau of Education, and the Bureau of Forestry. For the past five months the timber-testing laboratory at Bilibid Prison, in charge of the Bureau of Forestry, has been conducted by Dr. Foxworthy, of the botanical section of this Bureau. The publications of the Bureau on botanical subjects may be ascertained by consulting the Philippine Journal of Science.

Dr. Foxworthy has continued his studies on the comparative anatomy and histology of Philippine woods and the first paper on the subject will very soon appear. The work of Dr. Foxworthy relating to Philippine *Gymnosperms* and Philippine *Casuarinaceæ* is not nearer completion than it was last year, as the necessary literature is still lacking.

A number of observations and records regarding the growth and the physical and chemical properties of commercial woods have been begun. Studies in conjunction with the Bureau of Forestry on the determination and classification of forest trees and forest products are under way.

THE ENTOMOLOGICAL SECTION OF THE BIOLOGICAL LABORATORY.

The entomological section has undertaken experiments in the cultivation of silkworms as one of the new features of the work, and the investigation of mosquitoes with reference to their life history and to the transmission of malaria by the Philippine forms has been continued. A list of 83 species of mosquitoes has already been published among which are 8 new ones and one new genus, and material now on hand will bring the number of species up to 100. A series of papers on the anatomy and biology of Philippine mosquitoes, including many drawings and various notes of the different stages of the life cycle, is well under way, but certain important gaps will need to be filled in before the work can be published.

The entomological collection has steadily grown and much work in identification and arrangement of specimens has been done both by

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Mr. Schultze and by Mr. Banks. A large number of identifications were accomplished by Mr. Schultze during his leave in Europe. The work, as is the case with botany, suffers much from lack of space and of assistance in the routine of pinning and caring for insects. It seems probable that, rather than to engage one man especially for this purpose, we might train students of the High School and Normal School to undertake this work at a small compensation, sufficient, perhaps, to help out in their school expenses. Two of these young men have already been tried and have proved themselves to be very useful and possibly we can extend this service to advantage.

The work of the systematic collection of entomological material has necessarily been kept in abeyance owing to our desire to cultivate the larger field of investigation looking to the prosperity of the Islands. It is hoped that during the next year we can arrange some sale system by which we can obtain an income from the entomological work.

The past year has brought fewer notices of the ravages of locusts than previously.

THE ZOÖLOGICAL SECTION OF THE BIOLOGICAL LABORATORY.

Field work during the past year has been conducted especially for the purpose of collecting birds, although land shells, reptiles, some mammals, and representatives of other faunæ were brought in by the expeditions sent out. The districts first covered were in Bantayan, Cebu, and at Toledo and Minglanilla in the latter island. Subsequently, a party was dispatched to Zamboanga and thence to Isabela on Basilan Island, and finally in May, 1907, Messrs. McGregor and Celestino visited the Island of Batan, in the Batanes group, collecting for about two weeks and afterwards spending a month on the Island of Camiguin to the north of Aparri. Five papers have been published in the Philippine Journal of Science and four are ready for the press. Important exchanges of specimens have also been made with the museum at Honolulu. The collection of bird skins and of other specimens is steadily growing and the number of duplicates is now sufficient for us vigorously to push the question of their sale. Indeed, it might be proper for the Bureau to attempt to prepare specimens in other directions for sale also and ultimately to establish a sales department similar to that in operation at the aquarium in Naples.

THE SECTION OF FISH AND FISHERIES OF THE BIOLOGICAL LABORATORY.

This section of the work was only begun in March of the current year when Mr. Alvin J. Seale was engaged to undertake the organization of the work. Mr. Seale before coming to the Islands spent a month in the study of the latest methods of the commercial fisheries on the Atlantic coast of the United States. He visited the fisheries of New York, Boston, Gloucester, and the Potomac. Letters to the managers of

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the principal fishing companies were procured through the courtesy of the United States Bureau of Fisheries, so that a close inspection of the factories, vessels, nets, and other paraphernalia was possible. Mr. Seale paid especial attention to a study of the curing, canning, and disposition of the catch. On coming to the Islands he brought with him 200 large-mouth black bass, which were secured at Fulsom, California, and which were transplanted with the loss of only 23 individuals. These were planted in three localities at Baguio and on July 1 they were reported as being alive and doing well. At the same time, 2,000 of the eggs of the rainbow trout were brought, and almost all of these hatched, but owing to the high temperature of the water the process was so accelerated that the young fish had not sufficient strength to survive. It is possible that if the eggs were to reach here at the beginning of the cool season, when on occasion ice occurs on the higher Benguet plateau, young trout might be sufficiently large and strong at the beginning of the summer months to withstand the temperature. However, it is believed that small-mouth black bass would be better adapted to the streams.

In beginning the work in the Philippine Islands and in order to avoid expensive mistakes in developing the fisheries, the first essential is a thorough knowledge of the fish which are to be found, and therefore a catalogue has been started covering points to be investigated in regard to every food fish in the Islands. The catalogue contains the native name of each fish listed, as well as the English and scientific names; the life history—that is, where the fish is found, at what seasons, where the eggs are deposited, how the young fry develop, and what food is taken; it gives the method of capture, of preserving and selling, and the value, as well as suggestions as to future work. A collection has been started simultaneously and in connection with this catalogue. This will represent the food fish of the Islands, as rapidly as material becomes available. There are now about 500 specimens. A card catalogue has also been prepared of all the known species of fish in the Philippines, and one on the literature relating to the fisheries of these Islands and the adjacent waters is also under way. Mr. Seale has visited the markets each morning and has noted the different varieties brought in as well as their approximate abundance, and he has generally secured unfamiliar species for identification. He has differentiated those which are known to be poisonous or otherwise to be injurious. The fishing villages so far visited have been only Pasay, Malabon, and some parts of Tondo, where the native methods of fishing, as well as the nets used, have been studied. Mr. Seale also went out with the Japanese fishermen operating in Manila Bay and has observed the method they employ and the fish they secure. There is a prosperous and growing industry carried on by Chinamen in the smoking and drying of fish in Tondo, and it is believed that this method of utilizing the food fish of the country is capable of great expansion. A study of the fish ponds has been carried on in the

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neighborhood of Manila and a considerable amount of information is now available. Only the streams near Manila and the vicinity of Baguio, Benguet, have as yet been reached. A fair number of small goby were found in the Trinidad River, near Baguio, and these proved to be of a species new to science. They will furnish a plentiful food supply for the black bass which have been planted.

There can be no doubt as to the great value of the Philippine fisheries. There occur here the well-known *bañgos*, or milk fish, the *banak*, or mullet, many species of groupers (*lapo lapo*), snappers, pampano, tarpon, bonito, mackerel, and also herring and anchovies in countless numbers. The fisheries are not only capable, so far as the supply is concerned, of filling the needs of the home market but a large export trade with China should be started.

The fish survey vessel *Albatross* will leave for these waters about September 1 and will spend some time in exploratory work, but it should once more be emphasized that the Islands can not depend on this work alone for advancing the interests of their fisheries in the best manner.

NEED OF A DIVISION OF FISHERIES.

The section of fish and fisheries of the biological laboratory should be changed so as to give it the status of a division and ultimately it must have a permanent force, equipment, and laboratories. Not only the fish, but, as has been pointed out in previous reports, sponges, corals, pearl oysters, and other marine organisms are valuable, and it is as true in this work as in any other, that commercial advance and application can only come as a result of careful scientific study. In other words, it is my hope to see established here a well-equipped marine biological laboratory, with aquaria, a central station for investigation in Manila, and with one or more floating stations in various parts of the Islands. The expense of this undertaking will undoubtedly be returned to the Islands many fold in the advance of the fishing industry. When this industry is placed upon a more advanced footing and when the profits from the sale of dried fish to China and other countries begin to be apparent, it would not be unreasonable to impose a net tax on all fishing companies and in that way pay the expenses of the marine biological survey. At the present time this would not be feasible, so that the suggestion applies only to the period when the business of the fisheries shall have been thoroughly established on modern lines.

It is one of the most important undertakings to have the study of marine faunæ pushed as energetically and rapidly as is possible, and it is hoped that when the *Albatross* departs, the Philippine Government will be in a position to carry on the work thoroughly and well with a sufficient laboratory force and appliances, and it will then be asked to foster this division as assiduously as possible.

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THE CHEMICAL DIVISION.

During the past year it has been found necessary to divide the chemical laboratory into two sections, (*a*) the section of general analytical work and organic chemistry, and (*b*) that of weights, measures, and mineral analyses.

THE GENERAL ANALYTICAL AND ORGANIC SECTION OF THE CHEMICAL LABORATORY.

The routine work of this section has increased very much, but a falling off has appeared in the last month or so. Approximately twice as many analyses were handled during the past fiscal year as in the preceding one. The increase has arisen in part from certain classes of work sent in by other Government Bureaus, but it is also due to the fact that the commercial interests in the Islands are gradually coming to realize the money value to them of accurate chemical laboratory work and the laboratories therefore are frequently called upon for assistance by merchants.

The routine work has been such that it usually required the time of three chemists and in addition a portion of the time of all of the force of the chemical staff, but whenever opportunity offers, they do some of the work of investigation. The analyses have been systematized as far as possible by confining each chemist to a certain class of work and frequent consultations of the members of the staff are held to develop the best and the quickest methods of procedure. It has therefore been possible for the men to handle more work than formerly. Weekly meetings of the chemists are held, at which the recent advances in the science and the possibilities of the development of the economic products of the Philippines are discussed.

PUBLICATIONS AND INVESTIGATIONS OF THE CHEMICAL LABORATORY.

Dr. Clover, during the year, completed and published the results of his investigations on the terpenes of Manila *elemi,* which has occupied his spare time during two years. He showed that the resin from an individual tree usually contains but one terpene, and in that way, by studying the individual samples, he was able to identify the various terpenes which go to form the mixture known as Manila *elemi,* and to study their properties. The terpenes from Manila *elemi* would unquestionably be useful in varnish making and the residue which is left after distillation would also seem to be very excellent for this purpose, but it appears desirable, as we have at our command in the Philippines a large amount of this product and therefore are in a position to secure practically pure terpenes, that this subject be investigated as to the possibility of securing a higher standing for the oils than in the manufacture of varnish, namely, to utilize them for synthetic work. But little has been

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done with this class of chemical bodies in this respect, but it does not seem at all hopeless to carry on the work and ultimately to be in a position to synthesize a number of higher, important, commercial products from the terpenes in question. Work of this kind involves the best type of chemical research and of course successful results can not be guaranteed, but at the present time indications are not wanting that one way of utilizing those products has been found, and work in this direction will be developed during the coming year. In order to make the synthetic work possible a complete knowledge of the terpenes themselves is needed, and this was supplied by Dr. Clover.

Dr. Clover left the service of the Government on the 15th of January and Mr. Richmond was promoted to his place. During the first part of the year Mr. Richmond completed his work on the Philippine fibers and fibrous substances and their suitability for paper making, the later months being devoted especially to a study of the woods and of the applicability of the sulphite process to the preparation of paper pulp from hemp waste and the Philippine grasses. It certainly would be an advantage if these materials could be worked by the sulphite process, as is the case with wood pulp; and Mr. Richmond's results show that it is perfectly feasible and in fact advantageous to make paper from hemp waste and from grasses by this method. All of the results have been published in the Journal of Science. Mr. Richmond has shown that good paper can be prepared from cogon grass, from bamboo—both the dwarf bamboo and the structural variety—from the waste from hemp, from a number of Philippine woods, most prominent among which is lauan, and from other Philippine materials.

Mr. Richmond is now beginning the study of the Philippine oils and the resources of the Islands in this direction. A preliminary discussion of the subject is already at hand and was written before Mr. Richmond left on his vacation for the United States. The subject is one which will call for much further study and it probably will extend over a year, or a year and a half, but its importance is such that the results will warrant the time and expense. A number of oils other than those now considered commercially can be prepared in the Philippines and can take their place in the world's market, and it is the object of this Bureau to make the information concerning these products available in such a way that the manufacturer will interest himself in the subject.

Dr. Bacon during the year completed a preliminary discussion of the Philippine medicinal plants. He investigated about 15 of the most important native plants belonging to this class and did some work on the physiologically active constituents which he isolated. Judgment in regard to the value of all of this material will need to be delayed until we can have in the Philippine Islands a trained pharmacologist; indeed, it scarcely seems advisable to continue to spend large amounts of time on Philippine medicinal plants unless such a specialist is on the ground

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and until we can be in a position to have coöperation between the chemists and the pharmacologist. When this time arrives, the work, with the aid of the botanists, will once more be vigorously pushed. Dita bark seems to contain a very active alkaloid, echitamine, and a number of plants have been discovered which give a considerable quantity of berberine.

A number of the native fish and arrow poisons have also been isolated and studied. The fish poisons belong to the class of saponins. Biological work on this subject was carried on by Dr. Marshall in conjunction with Dr. Bacon and published in the Philippine Journal of Science. Dr. Bacon also visited Taal Volcano during the year and once more collected a number of samples of interesting waters from the crater lakes, especially obtaining material from the central hot lake where this had previously been impossible. The analyses of these waters furnished the basis for a memoir on the crater lakes of Taal Volcano. Opportunity presented itself while the question of the radioactivity of these waters were being investigated, to study the catalysis of various substances by means of uranium salts in the sunlight. This paper is entirely of theoretic interest, but as it could be carried on without disadvantage, the results were published. The value of the study lies in the fact that it gives a means for the quantitative measurement of the effect of the tropical sunlight, as compared with that of temperature zones. Dr. Bacon also assisted the Director in refuting some criticisms which had been made on work published by the latter while he was connected with the University of Michigan, and as a result an experimental paper on the action of sodium on acetone was prepared and published. Dr. Bacon has taken up the investigation of the gums, resins, and essential oils where Dr. Clover left it.

A study on the oils used in perfume, such as ylang-ylang, champaca, and sampaguita, has been begun and some data are available. It is hoped that during the present season we can obtain the coöperation of manufacturers, so that the laboratory will be able to establish normals for these products, which will serve as a basis for valuation.

THE SECTION OF WEIGHTS, MEASURES, AND MINERAL ANALYSES OF THE CHEMICAL LABORATORY.

Act No. 1519 of the Philippine Commission, regulating the inspecting and sealing of weights and measures, went into effect during the year, and as a result the actual work of standardizing has been begun. All of the weights, measures, and instruments of precision which have gone or are going to the provinces to serve as secondary standards have been compared, and the measuring flasks have been marked. The laboratories have received their fundamental standards from the International Bureau at Paris, and the instrument maker has built a comparator which is sufficiently accurate for all of our purposes.

It became evident during the past few years that the price which has

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been charged for assays, while it was a reasonable one in this country, was too high to make the assay work of practical value to the miners, and consequently a reduction in the schedule of charges was adopted. The present charge is a very low one, that is, $1, United States currency, for a gold assay, as it is scarcely sufficient to cover our expenses unless very large lots are taken in at a time. However, it seemed extremely desirable in the interests of mineral development to give the miners an opportunity to have accurate and authoritative assays made at a practically nominal charge, especially as so much work of the laboratory is done without any remuneration. The result has been that, whereas for the previous year we had 233 assays to record, during the present one we have 621, and during the season of activity we have been somewhat overcrowded. As a rule very few samples are sent in during the rainy season.

The presence of the assay furnace in the main building became extremely objectionable, as a very good room which would be available for mineral analyses was sacrificed, and consequently a small house was built for assays away from the main building and in that manner space for one more chemist was obtained. The assay building contains the ore crushers, grinders, and all other necessary machinery and the crucible and muffle furnaces. This improvement has made it possible for us to carry on modern assay work with great facility. The number of coal analyses and of calorific determinations has been very much augmented owing to the increased interest in Philippine coals. There were 15 of these determinations made during the preceding year and 75 during the present one. These figures do not include the work done for the division of mines and for other Bureaus of the Government, or for the purposes of research. They simply represent the work done for private individuals for pay.

PHILIPPINE COALS.

Research work of as great a scope as is at present possible has been carried on and a number of contributions from this section have appeared in the Philippine Journal of Science. Dr. Cox made extensive investigations on the coals of the Philippines, giving especial attention to their gas-producing power. All of these coals are noncoking and it probably would not be profitable to use them for ordinary gas making, where the coke is an important by-product, but they could be successfully employed in a producer-gas plant which would save nearly the entire value. All of our experiments indicate that the most economical method for the consumption of Philippine coals would be as producer gas, and the results have been so promising that the Bureau hopes to establish a trial plant in the near future, if funds for this plant are given by the Commission. When it is in operation we can add very definite data to our present information. The empirical methods generally used for the analysis of coals are not applicable to those of the Philippines, owing to certain peculiarities of the latter. The analyses, as carried on by the

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official method, indicate our coals to be of a much poorer quality than is actually the case. As a result Dr. Cox was compelled to work out a method which gave satisfactory and reliable results and which showed our coal to be comparable with the sub-bituminous coal of America and of other places.

The laboratory has been equipped for actual steaming tests under the boiler, and it has endeavored to obtain Philippine coals from representative sources, but unfortunately the amount so available has been very limited and from many places we have not been able to obtain any at all. Of course, we have completed all tests of other coals available in the Manila markets for purposes of comparison, but it is feared that unless we can have brought to the Bureau a greater variety of materials, the publication of the actual steaming tests will be greatly delayed.

The subject of Philippine coals is of the greatest importance. We suffer here from coal prices which to the commercial world are almost as serious as an epidemic of a contagious disease is to the multitude. Efforts in every direction should be made to advance the production and utilization of our Philippine deposits and to discover how much coal is available, and more especially what its quality is. I have heard Philippine coals condemned by persons who are utterly unaware of their nature or quality. It is true that in order to burn successfully many varieties will probably need a specially constructed firebox in the furnace, as the gas produced from this coal is so excessive as to cause great heat in the stack and loss in the firebox, but surely boilers and fireboxes can without great difficulty be so constructed as to take advantage of this condition, and certainly these coals can be used to great advantage in a producer furnace, by which means nearly all the combustible material will be made available. It is not good commercial practice to condemn a material simply on hearsay, but it is good commercial practice thoroughly to study and examine coal which is as plentiful as that in the Philippine Islands and to ascertain the best method for its utilization. A reduction in the coal price would be an inestimable gain to the inhabitants of the Islands. I believe that the Government should foster coal development in every way within its power, and the building of the producer-gas plant would be one of the means by which this could be accomplished.

PHILIPPINE CLAYS.

Information relative to the quality and distribution of clays in the Philippines is being sought more and more frequently and therefore we have undertaken work in this direction, paying attention to possible cement materials. The difficulty which the chemical division labors under is that while many clays are brought in and found to be proper for use, our knowledge of the extent of the deposits, their area, cubical

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contents, etc., is most meager, and we also, with the exception of a few places in Ilocos Norte, have not as yet developed a knowledge of ample deposits of feldspar and quartz to assist in porcelain making. The mining division, owing to its reorganization, has a position vacant and it is proposed to engage therein a man qualified especially for this work.

THE DIVISION OF MINES.

Mr. H. D. McCaskey, formerly Chief of the Bureau of Mines, and afterwards chief of this division in the Bureau of Science, left for the United States on July 1. Mr. Eveland, after completing his work on the survey in Benguet, resigned on January 15 of this year, and Mr. McCaskey without returning, also severed his connection with the Bureau, consequently the work of the division of mines has been in a somewhat disorganized condition. Mr. Ickis was on vacation in the United States from August 2 to February 22 and as a result we had practically only one man in the field from July to September. Mr. Smith was engaged on petrographic work on the Benguet rocks and in the care of the fossil material, but during the month of September he was able to visit Ilocos Norte to investigate the reported asbestos and manganese deposits in that region. The results have been published in the Philippine Journal of Science. After October 1 and to December 5, Mr. Smith was not only writing up his material obtained in Ilocos Norte, but making ready for extended field work in Cebu, where much of the map work had previously been prepared by Messrs. Goodman and Ickis. On December 5 Mr. Smith took the field and began the large undertaking of geologic mapping of the coal regions of Compostela and Danao fields in Cebu. He was joined by Mr. Goodman in January so as to facilitate the work on the map. Mr. Smith, upon his return from Cebu, was placed in temporary charge of the division and has continued as acting director up to the present time. The extensive investigations in the geology of the coal regions of Cebu and the preparation of the map, as well as the working up of the materials which were then obtained, have occupied much of his time, but on April 21 he was able to accompany an expedition of the First Batallion of the Second Regiment of the United States Marines, Major E. H. Cole, commanding, from Olongapo to Mount Pinatubo in Zambales Province. They returned to Manila on May 2. During this time he made a rapid reconnoissance of this unknown region and also did some work in the vicinity of Subig Bay. Mr. Ickis returned to Manila on February 22 and was at once dispatched to the Camarines to make a preliminary inspection of the gold region in the vicinity of Paracale and Mambulao. From there he went to the Island of Polillo to inspect the coal workings and thence overland from Infanta to Manila. The report is now being carefully prepared, as much material has been gathered. Preliminary suggestions in regard to this region were published in the mining number of the Far Eastern Review.

Mr. Henry G. Ferguson arrived in Manila on March 28 to take the

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place left vacant by Mr. Eveland, and for the first month after his arrival he assisted very largely in the petrographic work. On May 19 he was sent as a member of an expedition of scientists to the Batanes Islands, and subsequently he proceeded to the Island of Camiguin to the north of Aparri. The material which he has gathered on this trip, which relates to a group of islands but little known, is being prepared for publication.

Mr. Goodman also made a rapid reconnoissance in the latter part of 1906 in the Island of Marinduque, paying particular attention to the lead deposits reported to occur there. He was gone in the field about a month.

Owing to the disorganized condition of the division, to the separation of so many men and to the fact that Mr. Ickis was on leave, no publication excepting a contribution to the physiography of Cebu Island, by W. D. Smith, was made, but since we have once more begun systematic work, press-bulletin notices have been issued in each number of the Far Eastern Review, the division of mines having adopted this means of reaching the public with information of interest relating to mining subjects. These bulletins contain special announcements, short articles of commercial interest, discussion so far as is possible of nonmetallic minerals, and quotations and prices of chemicals and metals. The division has also coöperated in the editing of the mining edition of the Far Eastern Review and contributed four articles thereto.

ORGANIZATION OF THE DIVISION OF MINES.

It became evident that to obtain the best results a reorganization of the division was necessary with a graded list of salaries, so arranged as to give each one an apportunity for promotion; after the final adjustment the division will be as follows:

A chief of the division in charge of geology; a mining engineer who shall have charge of the section of mineral resources; a mining engineer and topographer; a geologist who will take up petrography and ore deposits; an assistant geologist, whose work shall be in nonmetallic minerals, such as clays, coals, etc.; and two field assistants. It is proposed in future to abandon the former policy of minute, detailed and expensive surveys of particular regions which, while of great importance scientifically, do not cover a sufficient amount of territory actually to give us a reconnoissance of the geology of the Philippine Islands. To cover large areas in the minute way in which we began would take resources far greater than we can ever hope to command. Consequently, the scope of the work for the future has been planned about as follows:

1. Geological reconnoissance work.
2. The investigation of economic materials, chiefly of fuels and materials for construction.
3. Statistical work.
4. Mapping.

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It is proposed to bring the work before the public in the following series of publications:

(*a*) An annual bulletin on the mineral resources of the Philippine Archipelago, to be issued at the close of each calendar year. This bulletin will be statistical in character and we shall endeavor to gather from all mining sources the results obtained during the preceding year and the value of business done. It should serve as an exact index of the mining industry in the Islands.

(*b*) Special geologic and geographic articles which have a scientific value and which will appear in the Philippine Journal of Science.

(*c*) A system of press bulletins consisting of short articles and announcements of field work will, as heretofore, be given out in the Far Eastern Review.

(*d*) It is also proposed, with each publication in the Journal, to issue separate sheets of the geologic and topographic maps so that they shall be available to the miners.

PROPOSED NEW WORK.

When the work on the Cebu coal regions is completed, and the geologic map is now very nearly ready for the press, Mr. Smith will begin the reconnoissance work in Mindanao which we have long had in mind, while Mr. Ferguson and Mr. Ickis, with one assistant, will proceed to Bulalacao in Mindoro to study the coal fields of that region. Mr. Ickis and the assistant will execute the preliminary triangulation and run one or more level lines for control. Mr. Ferguson will fill in the topography with a plane table and later make an areal map of the geology. While waiting for Mr. Ferguson to be ready to proceed to Mindoro, Mr. Ickis will take the field in Masbate, where he will map approximately 40 square miles. He will then, after the work in Mindoro is completed, be joined by Mr. Ferguson and the assistant. The reconnoissance of Mindanao is planned to cover the Davao district, the district of Cagayan, that of Placer, the Agusan River, and Zamboanga. The party will consist of Mr. Smith, Mr. Goodman, possibly Mr. Ickis or Mr. Ferguson, and an assistant. The commanding general of the Department of Mindanao has promised coöperation and assistance, together with the detail of men to make this expedition a success. The work will probably occupy five months. When the party returns, three months at least will be needed to finish the report.

PUBLICATIONS OF THE DIVISION OF MINES.

The following articles are in press or completed for publication: Geography and Geology of the Baguio Mineral Region, with maps, by A. J. Eveland; Petrography of Some Benguet Rocks, by W. D. Smith; The Asbestos and Manganese Deposits and Related Geology of Ilocos Norte, Luzon, P. I., by W. D. Smith; The Compostela-Danao-Carmen

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Coal Fields of Cebu, P. I., with topographic, geologic maps and relief models, by W. D. Smith and J. G. Gwastney; Contributions to the Physiography of the Philippine Islands: the Region of Mount Pinatubo, Zambales Province, P. I., by W. D. Smith; Geological Reconnoissance from Infanta to Laguna de Bay, Luzon, P. I., by H. M. Ickis.

NEEDS OF THE DIVISION.

The division has just passed through its reorganization and it is yet too early to expect the greatest results. However, it might be well here to mention some of the needs I have suggested in the preceding year. One necessity consists in more ample floor space. The geologic, paleontologic, and petrographic collections are growing, and with the field work planned, together with the method of rapid reconnoissance, these necessary adjuncts to geologic work will increase more rapidly in the future than in the past. There certainly should be here a well-organized collection typifying the mineral resources of the Islands and it is impossible to care for such a collection in the few rooms which can now be assigned to the division. The plan of the laboratory wing which has been prepared will make ample provision for necessary expansion and it is hoped that before another year is completed we may be in a position to advance our collection rapidly. The library of the geologic, mineralogic, and petrographic section of the work has grown as rapidly as funds would permit, but, just as is the case with the work in fisheries, we are as yet but poorly equipped. Other divisions which began at the time of the organization of the Bureau of Government Laboratories are therefore far ahead of the later additions, and much must be done in the way of giving the division of mines more ample library facilities.

The subject of topographic surveys has already been mentioned; the success of the division of mines depends upon this class of work, and we could cover very much more ground if we were able to rely upon completed topographic maps. However, as at the present time this is out of the question, the division must endeavor to do what it can. In the last appropriation bill there were given to the division of mines two positions for topographers. The opportunity to study on new geological work is so great that it might not be impossible to obtain two promising young men, just finishing their bachelor's course in the United States, as temporary assistants for one or more years; the salary would be enough to pay expenses and what these graduates would learn would more than amply repay them for the time spent in coming here. Until we can discover whether this course is feasible, the two positions in question will be filled temporarily, as field work requires.

It is hoped that within the next year the plans which have been outlined will have given encouraging results. Everyone realizes that we could do more with twice the staff and still more with three times the number of men, but our work in the field of mining and geology must be limited by the sums which the Government can actually afford, and it

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is to the interest of every member of the division actively to push his work within the means allowed him and not to let his mind dwell on what might be possible were he confronted by different conditions. Active coöperation between the mining and chemical divisions is necessary, with full realization that research is for all who have the means and talent, and that no arbitrary line can be drawn where the functions of one division cease and those of the other begin, without seriously hampering work which is in the interest of the Islands.

THE DIVISION OF ETHNOLOGY.

The division of ethnology of the Bureau of Education was transferred to the Bureau of Science on November 1, 1906. From the time of its beginning as the Bureau of Non-Christian Tribes, this portion of the scientific work of the Government has been moved from one place to another. In each instance a great loss in valuable material resulted. There was absolutely no space in the Bureau of Education for displaying what was on hand and owing to the activity of the exposition board for the Louisiana Purchase Exposition, much material was gathered in the last few years which urgently needed attention and display. The method of storing the exhibits and the numerous transfers to which the glass cases had been subjected resulted in much destruction and breakage. It was consequently a great advance in the interests of this division when the Bureau of Science was able to secure the control of the entire upper floor of the building formerly occupied by the Bureau of Architecture. The length is approximately 150 feet and the width about 70 feet, and the floor space is divided by half partitions. After this building had definitely been assigned to the Bureau of Science, contracts were let for its repair and for the construction of a number of glass cases and frames to display the exhibits. The moving was very much delayed and only completed at the time of writing, so that the work of the division in the immediate future must be the thorough overhauling, cleaning and repairing of all exhibits and placing of them in their future locations. It is intended to open this museum to the public, but obviously this can not be done until everything is in order. An inspection of the material on hand makes it evident that some money will need to be expended for the hire of mechanics to fit glass and to repair the exhibits which have become broken.

The ethnological work has suffered owing to the fact that Dr. Merton L. Miller, its chief, was most seriously ill during the year and was finally compelled to leave for the United States for vacation and recuperation. He will return about the middle of October. During this interval the affairs of the division have been in charge of Mr. Christie, who has been at work on the material gathered during a trip to Mindanao, where he studied the customs, habits and ethnology of the Subanos. The publication has not been completed, it having been delayed by the unfortunate surroundings of the division, and now Mr. Christie's time will need to be devoted to placing the exhibits in their proper order. The manuscript

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will be thoroughly edited and prepared for publication upon the return of Dr. Miller. Two other manuscripts have been submitted and are now in the hands of the printer. One, an English-Igorot Vocabulary, by the Reverend W. C. Clapp, and the other on the Batán Dialect as a member of the Philippine Group of Malayan Languages, by Otto Scheerer. Both of these are important contributions to linguistic studies and they will be useful to travelers. It has therefore been decided not to publish them as numbers of the Philippine Journal of Science, but rather to issue them in the same form as the Journal as separate publications at cost price. Another manuscript of Dr. Najeeb M. Saleeby on the history of the Moros is now in the hands of Dr. Miller for editorial reading.

With the aid of the division of mines, as good a map as is possible at the present time of Jolo and Mindanao has been prepared to accompany Dr. Saleeby's work, the second portion of which will relate to the Moros of Mindanao.

It is hoped that all the papers now in preparation will be published during the coming year, but necessarily they are all somewhat delayed owing to the absence of Dr. Miller.

In its present quarters, with its staff intact and with its increased facilities for caring for exhibits, the ethnological division should begin a new era and we should steadily endeavor to increase our collection. If such collections are delayed too long the available material for them will rapidly diminish, and later, great difficulty will be encountered in completing a picture of the wild tribes of the Philippine Islands as they at present exist. It will be the aim of the Bureau to foster this division to as great an extent as its means will permit.

THE PHOTOGRAPHER.

The number of prints made during the last fiscal year was very much greater than in any similar preceding period, the total being well over 20,000. One class of work was undertaken for which there had previously not been much demand, for during the year we made 319 lantern slides. The photographer, Mr. Martin, made two expeditions, one to Mindanao where he photographed a good series of Subanos, taking about five weeks, and another to Mayon where he obtained collections from the volcano, having ascended the summit of the mountain during the expedition. The work of replacing the old negative envelopes, of cataloguing and classifying all negatives, and of completing the catalogue begun by the Honorable the Secretary of the Interior occupied about six weeks toward the end of the fiscal year. In order to make the work at all possible, four temporary employees were engaged who spent all their time on our negatives. The result is that at the present time all the envelopes have been typewritten, the negatives have been classified and numbered both in the regular album and catalogue and only a few varied subjects remain to be adjusted.

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THE POWER-PLANT.

There have been no additions to or alterations in the power-plant, the only change being in fitting up the boilers to make evaporation tests of fuels. During the latter part of the year we obtained from the Bureau of Forestry, by transfer, an impregnating apparatus for wood which is sufficiently large to handle a railroad tie. The apparatus is now set up in the boiler room and prepared for operation. One difficulty lies in the fact that the cost of creosote in these Islands is high.

The engineer during the year has prepared a plan for a producer-gas plant which we hope to be able to erect in connection with our boilers and in which we expect thoroughly to test our Philippine coals. The cold-storage room has been improved by additional insulation and in that way we have very much cut down the expense. The workshop has completed quite a number of jobs and much has been done in the way of repairing and keeping apparatus in order. A new universal milling machine has added much to the efficiency of the machine shop. We have during the year been able to employ two or three Filipino boys as student apprentices without pay. The results have been quite satisfactory. So far we have had six of these boys; two have found employment in other Bureaus, one in the Bureau of Navigation, one with a commercial firm in Manila, and two remain as students in the shop.

I am, very respectfully,

PAUL C. FREER,
Director of the Bureau of Science.

The SECRETARY OF THE INTERIOR,
Manila, P. I.

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APPENDIX.

TABLE I.—*Comparative table of serums and other preparations made and disposed of during the fiscal years 1906 and 1907.*

[July 1, 1907.]

Serums, etc.	1906.	1907.	Excess.	
			1906.	1907.
Vaccine virus:	*Units.*	*Units.*	*Units.*	*Units.*
Prepared	2,250,505	2,804,042		553,537
Disposed of	2,316,785	2,846,687		529,902
Anti-rinderpest:				
Prepared	1,712,775	947,800	764,975	
Disposed of	1,324,225	1,376,550		52,325
Plague prophylactic:				
Prepared				
Disposed of	790		790	
Mallein:				
Prepared	699	837		138
Disposed of	1,976	830	1,146	
Diphtheria antitoxin:				
Prepared	210,000		210,000	
Disposed of	23,000	69,500		46,500
Tetanus antitoxin:				
Prepared	951,233	4,160,927		3,209,694
Disposed of	70,988	1,811,172		1,740,184
Cholera vaccine:				
Prepared	15,330	1,710	13,620	
Disposed of	10,140	1,650	8,490	
Anti-plague serums:				
Prepared	4,620	205	4,415	
Disposed of	120	30	90	

TABLE II.—*Comparative table of routine work performed by the Bureau of Science during the fiscal years 1906 and 1907.*

[July 1, 1907.]

Nature of work.	1906	1907	Decrease.	Increase.
CHEMICAL DIVISION.				
Oils, paints, pigments, etc.[a]		41		41
Clays, soils, fertilizers, cement[a]		24		24
Fuels, coals, wood, gas, petroleum[a]		30		30
Rocks and minerals[a]		6		6
Metals and alloys[a]		3		3
Food, alcohols, and beverages[a]		285		285

[a] Included in "Miscellaneous," Chemical Division, in 1906.

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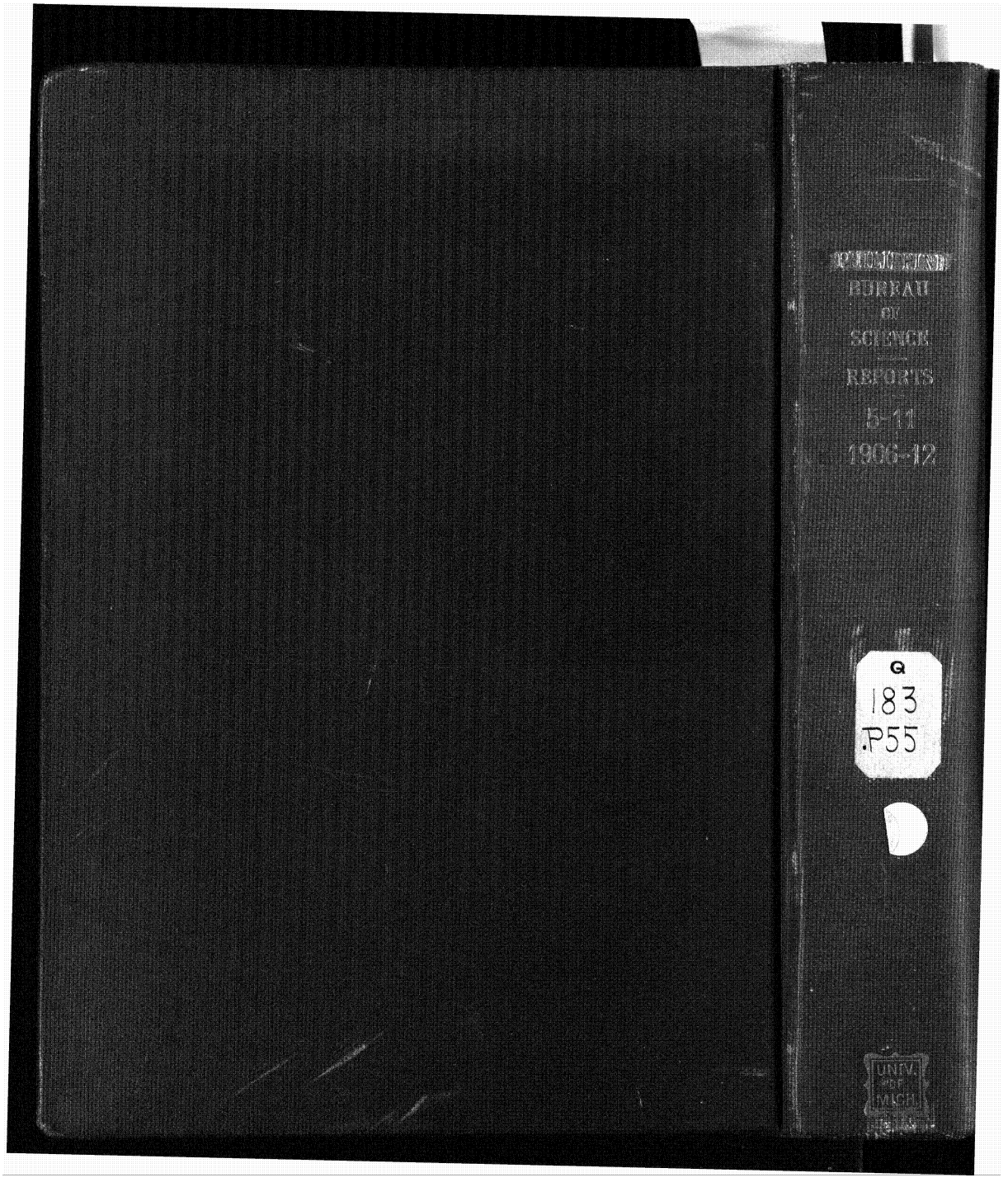

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